

REPORT

on

COAL RESOURCES OF TASMANIA in connection with the
POWER SURVEY of the STATE.Geographical Distribution of the Coalfields

The majority of the coal fields of Tasmania occur in the Eastern and South-eastern parts of the State. The coalfields not occurring in these parts are located in the North-western portion of the Central Plateau, in the North-western part of the State, and at the North-western extremity of the Midlands Plain. Coal is apparently absent from the Western and South-western parts of the State.

It was thought that coalfields extended continuously down the East Coast from Mt. Nicholas to Tasman Peninsula but extended investigations by the Geological Survey have proved that the region is not continuously coal bearing, but contains numerous small and isolated coalfields. The same features of isolated fields characterise the region from Hobart to Catamaran and South-East Cape.

Isolated coal-fields occur throughout the Midlands and the South Esk Valley.

Geology of the Coal-bearing Formations

The coal seams in Tasmania are contained in three of the younger sedimentary rock systems viz the Permo-Carboniferous, the Triassic and the Tertiary. These rocks are generally horizontally bedded or dip at angles up to 15° having been affected by block faulting and tilting without any folding. The basement upon which the above rests, consists of highly faulted and folded Lower Palaeozoic and Preterozoic sedimentary rocks with intrusive and effusive igneous rocks.

The details of the coal-bearing systems are:-

(a) The Permo-Carboniferous System.

The Permo-Carboniferous system of Tasmania possesses the same general characteristics of that system as developed on the Australian Continent. The Carboniferous system proper is absent, the lowest bed of the sedimentary system consisting of the basal glacial conglomerates of the Permo-Carboniferous. These conglomerates constitute the base of the Permo-Carboniferous wherever they occur in Tasmania, but there is a very great variation in its thickness in the various parts of the State, ranging from 15 feet in the Mt. Nicholas area to as much as 1200 feet in the vicinity of Preolenna.

Conformably overlying this basal conglomerate is the Lower Marine series of the Permo-Carboniferous. These consist of limestones, mudstones, and mudstone conglomerates, and vary in thickness from 30 feet at Barn Bluff to a maximum of about 1000 feet on the South-east coast. The series may be sub-divided into a Lower zone, characterised by *Pachydomus* in the southern portion of the island, and *Eurydesma* in the north, this and an Upper or *Fenestella* zone.

Succeeding this Lower Marine series there occur sandstones and shales with associated coal seams as a typical fresh-water series, and characterised by the *Glossopteris* and *Gangamopteris* flora. This series, known as the Greta Coal Measures, also has a great variation in thickness, ranging from 30 feet at Barn Bluff to 140 feet at Preolenna, and 850 feet at Bruny Island in the south. It is interesting to note that in certain localities this fresh-water series disappears, and some of these localities correspond to the tasmanite shale areas in which the tasmanite occurs as a marine deposit on the same geological horizon as the fresh-water series.

Conformably overlying the fresh-water series are the Upper Marine series, which consist of mudstones and mudstone conglomerates and limestones characterised by *Spirifera*, *Productus*, etc. This series varies in thickness from 50 feet at Preolenna, 970 feet at Barn Bluff, 100 feet at Mersey, 300 at Mt. Nicholas, and 500 feet at Upper Derwent. This Upper Marine series passes upwards into fresh-water sandstones and shales with coal seams. This series corresponds to the Tomago or Newcastle series of New South Wales. Its thickness varies considerably, and is 550 feet at Preolenna, 740 feet at Barn Bluff, 260 feet at Mt. Nicholas, and 200 feet at Sandfly, Cygnet. It is characterised by the *Glossopteris* flora.

The total thickness of the Permo-Carboniferous system, therefore, throughout Tasmania varies within wide limits. The approximate thickness at various localities is as follows:- 2400 feet at Preolenna; 1900 feet at Barn Bluff-Pelion; 500 feet at Mersey; 770 feet at Mt. Nicholas; greater than 110 feet at Upper Derwent; greater than 550 feet at New Town; greater than 1900 feet at Bruny-Cygnet.

The variation of the total thickness of the Permo-Carboniferous, and also the variation of the several series therein, are shown by the columnar sections on Plate II.

The rocks of this system show no signs of folding, being either horizontal or having a dip seldom exceeding 25 or 30 degrees. The structure is that of discontinuous blocks at elevations above sea-level varying from zero to 3000 feet. These blocks have reached their present positions through the effect of the upthrust of the diabase or subsequent post-diabasic block faulting.

(b) The Trias-Jura System

The Trias-Jura system appears to conformably overlies the Permo-Carboniferous but evidence of a disconformity has been obtained at certain localities. The basal member of the system consists throughout the whole of the island of grit or fine-grained conglomerate. The thickness varies from 1 foot to 50 feet, and is remarkably persistent.

The basal grit is conformably succeeded by what are known as the Ross sandstones. These are distinctly siliceous sandstones, characterised by the presence of white mica. They are white to yellowish-brown in colour. They are of fresh-water origin. This series varies in thickness from 200 feet in the Mt. Nicholas area and 700 feet in the Midlands, to 1350 feet in the vicinity of Hobart.

Conformably overlying this series is the felspathic sandstone series. This series consists of felspathic sandstones, shales, mudstones, and coal seams. It is wholly of fresh-water origin, and is characterised by a Neuropteris, Cladophlebis-Thinnfeldia flora. The total thickness of this series varies from 400 feet to 800 feet. This series contains the most important coal seams in Tasmania. These coal seams are associated with a shale zone occupying about the middle of the series.

This felspathic sandstone series is in most places overlain by diabase the presence of which has protected it from erosion. In some places, however, notably at Midlands, an Upper Siliceous sandstone has been recognized, the greatest thickness exposed being 200.ft. This series has obviously been subjected to great denudation, and its complete thickness has nowhere been observed.

The variation in the Trias-Jura system throughout the various parts of the State is shown in the columnar sections on Plate II.

The age of this system is given as Trias-Jura because the palaeontological evidence is such as to make it difficult to decide whether the age is Triassic or Jurassic. Correlation with the mainland formations has not yet been satisfactorily effected, and in view of the fact that these latter have not been finally correlated with European formations, makes it impossible at present to give any more exact determinations than that of Triassic or Jurassic age. The system being conformably to the features of the Permo-Carboniferous system, it naturally is characterised by the same structure features as that system, namely, a complete absence of folding or any other sign of compression, and a general horizontality of the beds within blocks thrown to varying levels by the effect of diabasic or Tertiary tensional block-faulting. Its distribution in Tasmania is that of isolated blocks, separated in most cases by masses of diabase.

(c) The Tertiary System

The only development of importance of Tertiary sedimentary rocks in Tasmania is that of some isolated patches of lacustrine sediments, such as soft sandstones, clays, ferruginous mudstones, sands and lignites. This rock series is most characteristically developed in the Launceston Tertiary basin, which has an area of, approximately 600 square miles. The maximum thickness of the system in this locality is 900 feet. The series is horizontal, and remains undisturbed in the original position in which it was deposited. The lignite or brown coal beds occur near the base of this system and do not exceed a few feet in thickness. Much smaller areas of similar sediments occur in the Upper Derwent, and on the North-West Coast, and in Macquarie Harbour. In each of these localities lignites or brown coals are developed, but the maximum thickness in any case does not exceed 10 feet.

The Tertiary system throughout Tasmania carries a flora characteristic of a warm temperate or sub-tropical climate. In the north-west portion of Tasmania marine Tertiary beds are developed. In the Wynyard area, in the vicinity of Table Cape the beds are about 50 feet thick. At Marrawah Tertiary limestones of considerable but undetermined thickness occur.

The whole of the Tertiary system in Tasmania, whether marine or lacustrine was deposited subsequent to the intrusion of the Permo-Carboniferous and Trias-Jura systems by the diabase, and also subsequent to the extensive erosion interval that succeeded the latter event. The Tertiary system, therefore, has sometimes been deposited on the diabase, and sometimes on the Permo-Carboniferous and Trias-Jura systems but although invariably horizontal it cannot be said to conformably overlies these latter systems.

Other geological features closely associated with the coal measures and which have a direct and important bearing on the coal-fields and their exploitation are the intrusions of Mesozoic diabase and the faulting. These two features are often intimately associated with one another.

(d) Diabase

Diabase (or dolerite) occupies a considerable part of the surface of Tasmania. It intrudes all rocks younger than the Trias-Jura, but reaches its maximum development in the Permo-Carboniferous and Trias-Jura systems. In these rocks it assumes the form of one or more huge irregular sills. The upper surface of these sills is particularly irregular, and numerous transgressive bodies of different sizes extend vertically from it and penetrate the overlying strata. These take the form of dykes ranging in width and length from narrow and short ones to very extensive dyke-like bodies. Sills are also associated with these intrusions.

Where the intruded and overlying strata have been removed by denudation, the diabase intrusions below have become exposed. The effect is that there exists numerous areas of the coal measures separated by diabase. These areas are often entirely surrounded by the diabase and also underlain by it at depth. This is the main reason for the occurrence of so many small and isolated coal-fields in Tasmania.

(e) Faulting

The coal measures have been largely affected by normal and block faulting. The downthrow of the faults ranges from a small amount in the case of the minor faults to 1000 to 2000 feet in the case of the major ones.

The majority of the faults have a general axial trend (from north-west to north-east) but numerous transverse faults occur).

In many cases the transgressive diabase intrusions are intimately associated with faulting in the sense that the intrusions must have followed fault planes developed synchronously with them. The strata on the two sides of the diabase intrusion may represent differences in the altitude of the same geological horizon ranging up to 2000 feet.

The faulting has a similar effect to the diabase in tending to cause the existence of small and separated coal-fields.

The prevalence of the faulting necessitates care in the siting and layout of mining works so that the working is not affected thereby.

Characteristics of the Coal

The characteristics of the coal depends principally upon the system of rocks from which it is derived, or in other words as to whether it is a Permo-Carboniferous, Trias-Jura or Tertiary coal. In addition there are differences in the coal from different seams in the one system and even in one seam from place to place.

(a) Permo-Carboniferous Coals

These occur at Barn Bluff, Preolenna, Mersey district and Mt. Cygnet. The coals are generally of the bituminous type with a tendency towards the variety known as cannel. They contain in the former two districts lens of more typical cannel coal or oil shales known as pelionite kerosene shale. In the Mersey district the coals are more typically bituminous. In the Mt. Cygnet district, the coals have been somewhat metamorphosed and are now of semi-anthracite types.

Chemical Analysis

Typical analyses are:-

	Moist- ure	Volatile Matter	Fixed Carbon	Ash	Sulphur
Preolenna	1.52	32.46	52.30	13.72	5.87
Illamatha	13.58	36.28	45.30	4.84	4.39
Spreyton	13.42	35.06	46.88	4.64	4.04
Mt. Cygnet	1.10	10.36	66.04	22.50	0.41

The outstanding features of the analyses of the coals from northern Tasmania are their relatively low ash content their high content of volatile matter and correspondingly low fixed carbon content, and their high content (4% to 5%) of sulphur.

Calorific Value

The calorific values are Preolenna - 12,204 b.t.n.; Illamatha - 11,056 b.t.n.; Spreyton 10,711 b.t.n. and Mt. Cygnet 11,336 b.t.n.

Uses

The coals (excepting Mt. Cygnet) would be suitable for steam raising, gas-making and domestic purposes if it were not for the high sulphur content. The coals together with contained oil shales should be especially suitable for distillation with the production of oils.

In addition to the sulphur, another detrimental feature is that the seams are generally thin (up to 3 feet or 3 feet 6 inches) and so are costly to mine.

(b) Trias-Jura

These coals occur in eastern midland and south-eastern parts and form the principal portion of the reserves of the State. The coals are generally of one type - the semi-bituminous, but show slight variations from district to district. In a few districts e.g. York Plains, the coals approach the anthracite type but with a large ash content.

Analysis. - The range of analysis of the usual type is - moisture of 1% - 4%, volatile matter 18% - 28%, fixed carbon 42% - 60% Ash 15% - 30%, Sulphur 0.2% - 0.6%.

A typical analysis may be taken as - moisture 4.30%, volatile matter 21.27%, fixed carbon 51.84%, ash 22.64%, sulphur 0.60%.

The semi-bituminous types have the content of volatile matter as low as 8% and the fixed carbon as high as 60%.

Calorific Value - The calorific values range from 9100 to 12,133 b.t.n., and it is assumed that a typical figure is 10,145 b.t.n.

Uses

The coal is generally a non-coking one and is of little value for gas-making. The ash content is rather high but in spite of this the calorific value is fairly high and the coal therefore has a use for steam-raising purposes. It is used on some of the state railway lines without any admixture, but on others a mixture with Newcastle coal is utilised. Special rocking bar grates are used to cope with the ash.

The coals have ignition points from 125° upwards, over 60% being over 150°. They are therefore safe under dangerous conditions and could be used in the pulverised form. The best results would probably be obtained from the coal in this form.

(c) Tertiary

The Tertiary coals occur at numerous localities, but their known thickness does not exceed 4 feet and little attention has been paid to them. They are all of the brown coal or lignite type.

Analysis

	Moisture	Volatile Matter	Fixed Carbon	Ash
Macquarie Harbour	20.8	33.45	33.5	12.25
Rosevale, West Tamar	15.1	39.1	29.2	16.6

Calorific Value. Not tested.

Uses

The brown coals might have similar uses to those of say Victoria, but the thinness of the seams has not encouraged investigation.

The Seams

(a) Permo-Carboniferous

The number of seams in this system ranges up to four at least. They occur on two horizons corresponding to the Greta and Tomago of New South Wales.

The largest number of seams occurs in the Freolenna coal-fields, where four exist in the Greta series and at least one in the Tomago. The thickness ranges up to 2 feet.

One or two seams occur in other fields e.g. one at Barn Bluff, two at Mt. Pelion, Mersey Valley, and Mt. Cygnet. In the Mersey Valley the seams are 18 to 24 inches thick and at Mt. Cygnet 1 to 3 feet.

(b) Trias-Jura

The maximum number of seams in this system is eight. These and the maximum number can generally be recognised. They probably also occur in the fields of south-eastern Tasmania but cannot be so readily detected. The seams have been named Alpha, Beta, Gamma, Delta, Eta, Theta, Iota and Kappa.

They range in thickness from 1 to 16 feet (including bands etc.) The thickness of the seams being mined ranged up to 6 feet.

(c) Tertiary

Little information is available as to the seams in this system. Only one seam has been proved to exist in any one district and the thickness ranges up to 4 feet.

General Conditions for Working.

In the greater number of the coal-fields the seams outcrop at the surface in the country of high relief. This permits the coal to be worked by adits or dip-adits with consequent economy in haulage drainage, etc. and therefore, low cost of extraction. Practically all the working mines are using this method of mining.

In a few districts the seams occur below the surface in country of low relief, where shaft mining would have to be used.

There is generally a sufficient without being excessive amount of water available for boiler purposes.

Timber suitable for mining purpose is usually abundant in the immediate vicinity

Reserves

The proved reserves include only small areas in the immediate vicinity of the mine workings. The actual amount of these is unknown and can only be regarded as small.

The probable reserves are large the estimates being based upon all available information from mines, bores and the geological structure. These are when based upon the existing economic conditions.

The details of the quantity of coal available under existing conditions for industrial purposes is given in the subjoined table:-

The total reserves based upon the scheme adopted by the Twelfth International Geological Congress 1913 are:

Actual	124, 980,000	metric tons
Probable	123, 013,000	" "
Possible-Small	to large	

Table II - Coal Reserves of Existing Economic Conditions

Coalfield	Coal Seams		Extent, Quantity available for profitable extraction under present Economic Conditions.	
	No. of Seams	Aggregate Thickness	Area in Acres	Metric Tons
Mt. Nicholas	2	9 ^{ft.}	4300	55,728,000
Fingal	3	11	1700	27,050,000
Dalmayne	3	15	700	15,120,000
Douglas River	1	4	460	2,208,000
Mt. Paul	1	6	640	4,700,000
Denison River	1	2	450	1,080,000
York Plains	1	3	40	144,000
Colebrook	2	4.75	250	1,425,000
Avoca	4	18	160	2,498,000
Catamaran	2	7	230	1,116,000
Sandfly	6	17	800	5,300,000
Cygnets	2	3.9	280	715,000
Lawrenny	4	10	250	2,740,000
Mersey	1	1.8	450	136,000
Longford	2	7	45	150,000
Buckland	3	9	40	288,000
Freolenna	4	6.5	760	5,000,000
Barn Bluff	2	2.75	5000	9,000,000
Total:.....				134,398,000

Working Mines and Present Production

The principal mines, together with their production for 1926 are:

<u>Mines</u>	<u>Tons</u>	<u>Value</u>
Cornwall	46,344	£35,860
Mt. Nicholas	29,535	25,595
Jubilee	14,403	11,971
Catamaran	9,950	14,130
Illamatha	1,240	1,737
York Plains	746	931

The Mt. Nicholas group (Cornwall, Mt. Nicholas, and in recent years the Jubilee) has always been the largest producer.

During the past few years the Catamaran mine has been opened for large scale production and has not yet maintained its maximum.

The Cornwall, Mt. Nicholas and Jubilee coal is used for railway, domestic, steam-raising and other purposes. The Catamaran coal has been finding uses for many purposes such as railway, steamers, cement manufacture, domestic use etc. The Illamatha coal is used for domestic and other purposes while the York Plains is used for drying hops exclusively.

Possible Production

The production from the more important mines for 1926 has been given above. The total production for the year was 102,358 tons valued at £90,401.

This amount is comparatively small considering the reserves of coal in Tasmania. This position is due to the fact that the production is solely for local markets, no attempts at export being made. The production could be greatly increased if markets were available.

The following table shows the increased productions possible from some of the working mines.

<u>Mines</u>	<u>During 1926</u>	<u>Maximum continuous with present equipment</u>	<u>Maximum continuous with additional equipment.</u>
	<u>tons.</u>	<u>tons.</u>	<u>tons.</u>
Cornwall	46,344	180,000	600,000
Mt. Nicholas	29,535	50,000	100,000
Jubilee	14,403	20,000	90,000
Catamaran	9,950	150,000	Unknown but greater than 150,000 tons.

The figures show that the maximum continuous output from these four mines is 400,000 tons per annum with the present equipment while with additional equipment this would be increased to 1,000,000 tons per annum.

Cost of Production

The cost of production of the coal at the different mines is not known with any degree of accuracy. It is better known in the case of the Cornwall, Mt. Nicholas and Jubilee mines which are all being worked from adits and have the same general factors to contend with. At these mines the coal is put into the railway trucks at the respective sidings at a cost ranging from 10 to 13 shillings per ton. The cost at any other locality would be the above plus the cost of transport thereto.

Power Development Notes

Proximity to Markets

At the present time the only important power markets are Hobart and Launceston. The larger and important coalfields are not situated adjacent to these cities, but nevertheless the distances are not excessive. The actual distances by railway, steamer etc. to the nearest market would be 50 to 85 miles. If electric power was generated at the mines, the distances for transmission of the power would be 40 to 60 miles.

Water Supply

Only general information is available as to the supplies of water for boiler and condenser purposes. It may be stated that the quantity of water would probably be readily obtained, though in most cases conservation might be necessary. Less information is available as to the quality of the water, but it is probable that with conservation schemes, the quality of the waters obtained would be satisfactory.

General

One important feature in connection with the coalfields of Tasmania is that they occur in districts where hydro-electric schemes are not possible to any large extent. The two sources of power are therefore so situated that between them they provide possible sources of power for all parts of the State. Though it would not necessitate long transmission lines in any part of the State to provide a district with power yet this occurring of coalfields as potential sources of power in districts with a general absence of hydro-electric schemes may have an important bearing on the development of the power resources in the future.

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